phenotypes generally had an opposite effect than the predictors for the 'severe' and 'bone density' phenotypes. Larger medial JSW, varus angle, osteophyte area, eminence height, and bone density at T0 were associated with 'severe' and 'bone density' progression. The 'bone density' model had AUC=0.91 (a multivariate model for 'severe' progression was not possible due to n value). Smaller eminence height and bone density were associ ated with 'early' and 'late' progression (AUC= 0.79, and 0.76 respectively). Larger varus angle and smaller osteophyte area were associated with 'no' progression (AUC=0.72).

Conclusions: This is the first study to identify specific phenotypes of radiographic knee OA progression in individuals with early OA complaints. Phenotypes represented the level (severe vs. no) and phase of progression (early vs. late), and the involvement of a specific feature (bone density). Baseline radiographic features could predict the phenotypes. The pheno types might represent relevant subgroups for the evaluation of treatment strategies in clinical trials, and with that drive the discovery of more tar geted treatment.

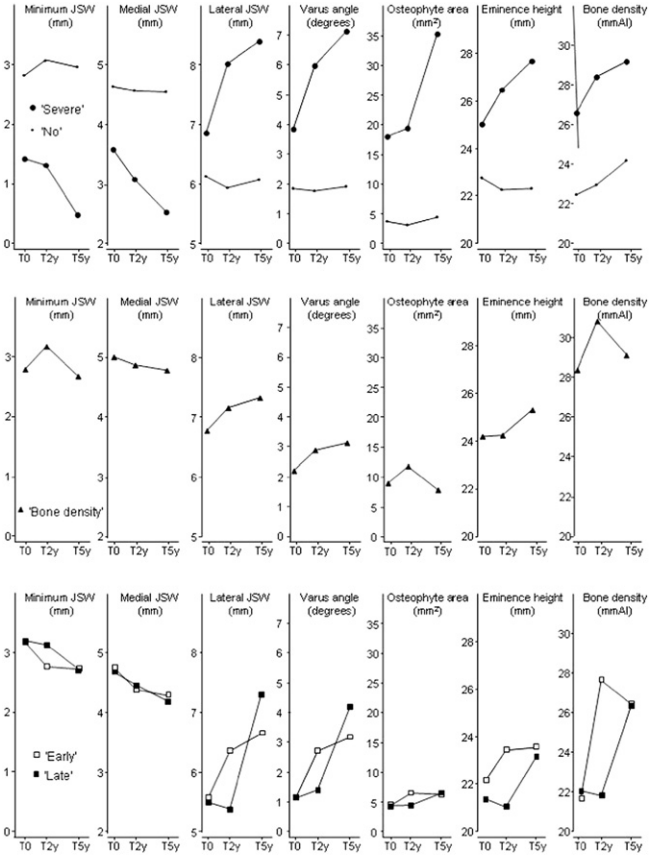

Figure 1: Development of radiographic features (right knee) per cluster of progression of radiographic knee OA. Results were similar for the left knee (data not shown).

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CAM TYPE DEFORMITIES STRONGLY PREDICT TOTAL HIP REPLACEMENT WITHIN 5 YEARS IN THOSE WITH EARLY SYMPTOMATIC OA: A PROSPECTIVE COHORT STUDY (CHECK)

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Purpose: Femoroacetabular Impingement (FAI) is a cause of hip pain and might induce osteoarthritis (OA) of the hip due to abnormal contact between the femoral neck and acetabulum. Two types of FAI can be distinguished: pincer and cam impingement. Pincer impingement is caused by overcoverage of the acetabulum relative to the femoral head, and cam impingement is caused by extra bone formation a cam type deformity in the anterolateral head neck junction. For cam impingement, the only treatment available is a surgical resection of the cam type deformity, which nowadays is performed with increasing frequency in young adults. However, the relation between those two types of impingement and the development of OA is unclear. The aim of this study was to determine the relation between cam impingement and pincer impingement on the development of both early OA and end stage OA after 5 years.

Methods: Individuals were extracted from the CHECK (cohort hip and cohort knee) study. CHECK is a prospective cohort study of individuals with assumed early symptomatic OA of knee or hip. Of the 1002 indi viduals, a random subset of 865 had standardized anteroposterior radiographs (AP) taken at both baseline and 5 years follow up. AP pelvic radiographs of sufficient quality were obtained in 723 subjects at baseline and in 770 subjects at the 5 years follow up. The shape of the proximal femur and acetabulum on the AP radiographs was assessed using statis tical shape modelling (SSM). Parameters used to quantify FAI morphology were automatically calculated from the point set of the SSM, using Matlab. For cam impingement, the alpha angle and Triangular Index Ratio (TIR) were measured. Threshold values used to quantify a cam type deformity were 60 degrees and 83 degrees for the alpha angle, and 0.05 for the TIR. To quantify a pincer deformity, the Lateral Center Edge angle (LCE) was used at a threshold value of 40 degrees. Further, all radiographs were scored for OA according to the K&L classification. The outcome measure for early OA were hips progressing from K&L=0 at baseline to K&L=1 after 5 years. Hips that had received Total Hip Replacement (THR) at follow up were classified as end stage OA. The strength of the relation between the impingement parameters and both outcome measures was expressed by means of Odds Ratios (ORs) using Generalized Estimating Equations.

Results: For this study, 682 females (mean age 55.8) and 183 males (mean age 56.4) were included. At baseline, 75% of the hips had no signs of OA (K&L=0) whereas 25% had doubtful OA (K&L=1). Crude and adjusted ORs for impingement parameters in relation with the develop ment of both early OA and end stage OA are displayed in table 1. No relation was found between any impingement parameter and the development of early OA. The measures for a cam type deformity were strongly associated with end stage OA. Especially the OR for a severe cam type deformity (alpha angle $>$ 83 degrees) was high (10.88, 95% CI 5.21 22.69, $p < 0.001$). No association was found between a pincer deformity and the development of end stage OA. Further, the risk for receiving THR when having a cam type deformity as determined by an alpha angle $>$ 83 degrees, $>$ 60 degrees, and by an TIR $>$ 0.05 was 23.3%, 9.6%, and 8.8% respectively.

Conclusions: A cam type deformity is strongly related to the development of end stage OA after 5 years, whereas a pincer deformity is not. Our results indicate that individuals having a cam type deformity that present with the first onset of hip complaints are at high risk (OR 11.3) for fast progression to end stage OA. Cam impingement might thus be the first risk factor that is highly predictive of fast progression for hip OA. Interestingly, it may be diagnosed and treated before hip damage is present which might prevent hip OA.

FAI parameter	Type of adjustment	**End-stage OA** (n=35) OR (95% CI, p-value)	**Early OA** (n=118) OR (p-value)
Cam deformity	No adjustment	**6.53** (3.3 - 13.0, p<0.000)	1.35 (0.42)
Alpha angle >60	Adjusted by sex & BMI	**6.81** (3.0 - 15.5, p<0.000)	
	Adjusted by age & sex & BMI & K&L	**3.91** (1.7 - 8.9, p= 0.001)	
Cam deformity	No adjustment	**18.30** (8.8 - 38.2, p<0.000)	1.84 (0.22)
Alpha angle >83	Adjusted by sex & BMI	**17.05** (8.3 - 34.9, p<0.000)	
	Adjusted by age & sex & BMI & K&L	**10.88** (5.2 - 22.7, p <0.000)	
Cam deformity	No adjustment	**6.12** (3.1 - 12.0, p<0.000)	1.58 (0.11)
TIR >0.05	Adjusted by sex & BMI	**6.43** (3.3 - 12.7, p<0.000)	
	Adjusted by age & sex & BMI & K&L	**3.68** (1.6 - 8.6, p=0.002)	
Pincer deformity	No adjustment	0.55 (0.18)	1.15 (0.51)
LCE >40	Adjusted by sex & BMI	0.57 (0.21)	
	Adjusted by age & sex & BMI & K&L	0.45 (0.08)	

Table 1. Odds Ratio (OR) is shown for each impingement parameter and both outcome measures.